sweeping most of Chippewa County. Friday was warm, but cooler than the preceding or following days; air, damp. About 11:30 p. m. the wind blew from the northeast with a velocity of 15 to 20 miles an hour. The clouds seemed blackest in the northwest, but the lightning came up from the southwest. The wind backed from northeast to southwest from 11:30 p. m. to 11:50 p. m. At that time I estimated from 100 to 150 flashes of lightning per minute. The wind increased, veering to the west and northwest, and rose to 40 miles or more I should judge, with pauses and more violent blasts. Three, or perhaps four of the most violent gusts of wind, lasting one to two minutes each, occurred just before midnight, the worst about 11:57 p. m. This prostrated trees and buildings, laying them east, about 5° to 8° south. Two minutes later, and lasting about two minutes, the wind blew violently from the southeast, directly reversed, and then veered rapidly south, southwest, and west, where it remained. Rain fell heavily all of this time, seeming to reach a climax about 12:05 a. m. The lightning was continuous, but the thunder was high and distant. Only two or three fires were caused by lightning. The hail was unusual, varying from small stones to cases, seemingly verified, of masses of ice, square, triangular and jagged, as large as a man's fist. One mass of ice is said to have been a foot square and to have weighed between 20 and 30 pounds. I have some woods traversed by three "windfalls" 2 to 10 rods wide. Some of the trees are twisted with the watch hands. On the north side the trees fell south; otherwise they are east-southeast.

CONCUSSIONS FROM NAVAL GUNFIRING FELT AT LOS ANGELES.

RAYMOND A. NELSON, Meteorologist.

[Los Angeles Chamber of Commerce, Apr. 25, 1922.]

The United States Navy seems to have chosen southern California waters for regular battle practice of the Pacific Fleet, the ships running from Los Angeles Harbor, their home, to a point 20 to 30 miles from the coast or off Santa Catalina and San Clemente Islands. This gives the ships a position 30 to 40 miles south to southwest of Los Angeles.

Frequently when the ships are at practice, concussions are felt in Los Angeles but with varying intensities. When the ships are firing, it is common to notice faint vibrations of windows and doors, but sometimes the vibrations reach such proportions that nearly everyone immediately says "earthquakes." Shocks of "earthquake" proportions took place on the evenings of January 17 and March 23, 1922, during night target practice. Papers over the country gave out wild reports following the first date; college professors in other parts of the State said it was impossible for the shocks to be felt as far as Los Angeles and that they were earthquakes. Seismographs throughout the State of California recorded no movements on that date and the MONTHLY WEATHER REVIEW for January reports that earthquakes were felt in California from the 26th to the 31st only and these mostly in the northern part of the State except for shocks felt in Imperial Valley where earthquakes are frequent.

I have studied earthquakes somewhat and made a complete record of the shocks that occurred in southern California during the summer of 1920 and at the instant of the shock of January 17 I timed it and tried to get a duration and direction. Nothing was moving, such as chandeliers, pictures, or other hanging articles, and yet the windows and doors rattled as loud as during an earthquake of intensity 6 or 7. Sixty seconds passed and another shock, then another, and at regular intervals for half an hour or so. There was absolutely no floor movement or other vibration except for the rattle of windows. This same condition occurred again on the evening of March 23 and at the same time. The reason for these great atmospheric waves affecting Los Angeles seems to be a question of pressure distribution and the meteorological elements resulting.

It is a well-known fact that sound coming from some point may be heard more distinctly at certain times than at others. The distance at which the sound may be heard is also variable. The wind direction plays a most important part in this, in that if the sound-emitting body is in the direction from which the wind is blowing, the sound will be carried a greater distance. Sound waves traveling against the wind will be retarded.

The weather conditions during the evenings of January 17 and March 23 were practically the same. At both times an area of low pressure was central over Nevada and Utah, with a rather weak high-pressure area off the north Pacific coast. Under these conditions southern California would experience southwest winds with unsettled weather and considerable cloudiness. These normal conditions were taking place on the dates in question. The southwest wind was not only a surface wind but in effect at an elevation of over 6,000 feet. The sky was cloudy and these atmospheric waves were traveling with the wind as the ships were to the southwest of the city. The flashes were the result of star shells used by the ships to locate the "enemy." Under normal pressure conditions the valley in which Los Angeles is situated would be under the influence of the regular land and sea breeze—the sea breeze (southwest) during the day and the land breeze (northeast) at night. Had the low-pressure area over Nevada not been so strong and the regular northeast land breeze blowing, the shocks or concussions would have been very faint had they been noticed at all.